ALUMINUM

Project Fact Sheet

Textures in Aluminum Alloys

Benefits

On-line measurement of formability parameters will allow strip cast production of aluminum sheet to be held to more stringent standards. Continuous strip cast aluminum sheet provides:

- energy savings of more than 26% compared to conventional ingot casting and rolling
- decrease in production cost of over 19% compared to conventional production methods
- secondary benefits of significantly reduced fuel consumption and emissions in the transportation industry

Applications

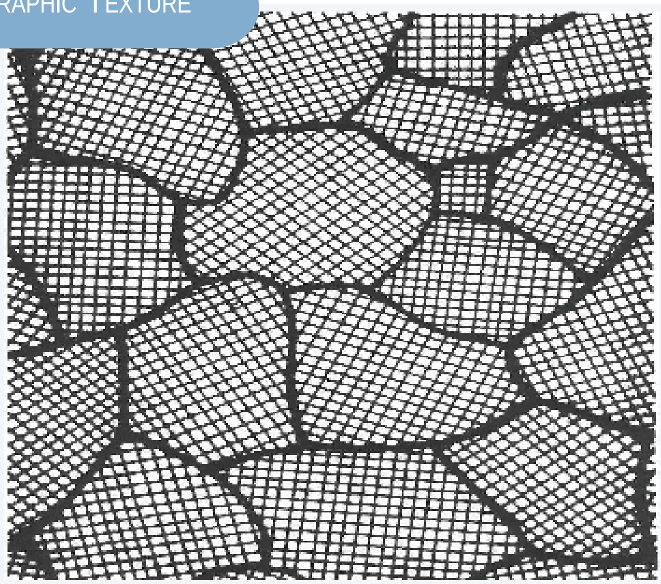
This technique for measuring sheet formability could be applied across all sheet production operations.

On-line monitoring and quantitative effects on formability of strip cast aluminum alloys

Aluminum sheets made by continuous strip casting provide an energy savings of greater than 26% and a cost savings of more than 19% compared to sheets made from ingot casting and rolling. Sheet formability is among the most important characteristics of aluminum sheet. Formability depends on the crystal grain structure and is a result of the casting method and processing sequences used to produce the sheet. The demand for aluminum sheets is increasing particularly in the transportation industry where they are used to produce lighter, more fuel-efficient vehicles. As more complex forms are required, improved process controls are needed. Industry currently relies on post-processing testing to determine formability characteristics of finished sheet. The on-line monitoring of the continuously cast sheet production process will allow simultaneous control of important forming parameters.

Crystallographic texture is related to the mechanical anisotropy/formability of metallic sheets. This project will determine if there is a quantitative relationship between crystallographic texture measurements at processing temperatures and aluminum sheet formability. Data will be collected from two different spectroscopic measuring devices. This data will then be analyzed to determine if these instruments can produce measurements of the formability characteristics. The instrument proven to be most effective for measuring texture and formability at processing temperatures will be installed on-line in a production facility to demonstrate the ability to measure and control formability in continuous strip production.

Crystallographic Texture



Crystallographic texture (preferred orientations of crystallites) strongly affects the formability of aluminum alloy sheets.

Project Description

Goals: This project is designed to develop techniques to monitor and control anisotropy/formability of continuous strip cast aluminum. Laser ultrasound and electromagnetic acoustic transducer (EMAT) resonance spectroscopy are two techniques that can measure bulk textures of hot metallic sheets. Samples of selected aluminum alloys will be measured at room and processing temperatures in the laboratory. Data collected from both instruments will determine if the crystallographic texture measurement can be quantitatively related to final product formability characteristics and to determine the merits and weaknesses of these different methods. The method shown to be most effective for measuring texture and formability at processing temperatures will be installed at a production facility. The measuring method installed will demonstrate the ability to monitor and control anisotropy in a continuous strip cast operation.

Progress and Milestones

- Measure and collect anisotropy/formability characteristic data and crystallographic texture data at processing temperatures from aluminum alloy samples that have undergone various thermomechanical processing sequences.

- Determine if anisotropic plastic behavior depends on quantifiable texture coefficients.

- Evaluate EMAT resonance spectroscopy and laser ultrasound resonance spectroscopy to determine which is most effective for process temperature monitoring of texture and formability.

- If one of the two techniques is shown to be effective for measuring texture and anisotropy of aluminum alloy samples at processing temperatures, the most accurate device will be installed in a production facility. The ability to monitor and control anisotropy in a continuous strip cast production environment will be demonstrated.

Commercialization Plan

Commonwealth Aluminum Corporation (CAC) will host the field tests for this project and the transfer of technology to CAC will be immediate. CAC will also find an end-user to serve as a secondary industrial partner of this project, which will facilitate commercialization efforts.

Project Partners

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